Security Risk Analysis of Broadcasting and Television Networks in the 5G Environment (Postprint)

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Abstract

With the application of 5G technology in the radio and television industry, it has not only significantly improved the efficiency and quality of radio and television program production, but also laid a solid foundation for the sustainable development of the radio and television industry in the future. However, the application of 5G technology in the radio and television field has also introduced certain network security risks. Only by correctly understanding the network security risks faced by radio and television in the context of 5G networks and taking effective countermeasures can the potential of 5G technology in the radio and television field be fully realized. Therefore, this paper analyzes and explores the security risks confronting the radio and television industry in the 5G network environment, and proposes corresponding mitigation strategies, aiming to provide references for enhancing the development level of China' s radio and television industry in the future.

Full Text

Analysis of Network Security Risks in Broadcasting Television Under 5G Network Environment

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Abstract: With the application of 5G technology in the broadcasting television industry, production efficiency and program quality have been significantly enhanced, laying a solid foundation for the sustainable development of the industry. However, this technological integration has also introduced new network security risks. Only by correctly understanding these security challenges in the 5G context and implementing effective countermeasures can the full potential of 5G technology in broadcasting television be realized. This paper analyzes

and explores the security risks facing the broadcasting television industry in 5G network environments and proposes corresponding solutions, aiming to provide references for advancing China' s broadcasting television industry.

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The application of 5G technology in broadcasting television significantly enriches content offerings, expands distribution channels, and profoundly transforms production methods, business types, and service models. In this context, the industry faces an increasingly complex network environment with heightened security risks. To ensure stable and secure development, comprehensive analysis of both business transformations and associated security risks in the 5G era is essential. Based on such analysis, targeted countermeasures must be formulated to strengthen security and establish a foundation for sustainable industry growth.

1. Changes in Broadcasting Television Business Under 5G Network Environment

1.1 Scope of Broadcasting Television Business

Unlike traditional satellite, cable, and wireless broadcasting services, 5G technology has rapidly expanded the business scope of broadcasting television to include fixed internet audio-visual services, mobile internet audio-visual services, and internet television. Leveraging 5G' s high speed, low latency, and massive connectivity, the industry has further advanced integrated services such as high-tech video and hyper-connectivity, substantially broadening the broadcasting television business landscape.

1.2 New Types of Broadcasting Television Business

High-tech video services provide users with advanced technical formats featuring high frame rates, high resolution, and wide color gamut, delivering superior audio-visual experiences through 5G technology. Currently, both traditional broadcasters and new media platforms are vigorously promoting on-demand high-tech video services, which have become a major industry trend. Specifically, these services include several key areas.

1.2.2 Ultra-High-Definition Video Services Ultra-high-definition video services primarily meet the demands of live sports, performances, and news broadcasting. By harnessing 5G technology, 4K and 8K video signals can be

transmitted rapidly to ensure optimal viewing experiences. Additionally, high-definition cameras capture scenes from multiple angles, transmitting footage with minimal latency to create an immersive, on-site sensation unattainable through traditional broadcasting.

1.2.3 VR Technology Services VR technology provides immersive experiences, initially developed for gaming and recently expanding into live broadcasting, education, and healthcare. In the 5G environment, broadcasters can conduct multi-angle high-definition capture of large-scale events and concerts, using VR technology to stitch and reconstruct footage for lifelike viewer experiences. Alternatively, computer-generated three-dimensional virtual spaces can be wirelessly transmitted to VR devices via 5G, a common application in gaming and education that delivers immersive experiences while eliminating traditional wired constraints.

1.2.4 AR Technology Services AR technology, derived from AI and human-computer interaction technologies, superimposes virtual three-dimensional images and audio onto real-world displays at precise positions and angles through computer simulation. Unlike VR, AR primarily utilizes head-mounted transparent displays, smartphones, and handheld projectors. Applications include live broadcasting of concerts, sports events, and galas, as well as on-demand services, gaming, and various industrial and commercial uses.

1.2.5 MR Technology Services MR combines VR and AR technologies, mainly applied in online gaming and video entertainment, enabling audiences to participate in television programs or substitute characters in films for virtual performances.

1.2.6 5G Production and Broadcasting Business Previously, 4K, 8K, VR, and AR services could not be widely deployed due to transmission speed and latency limitations. However, 5G technology optimizes content acquisition, editing, production, and transmission, making high-definition image capture and distribution feasible. Currently, some broadcasters have begun implementing multi-screen multi-angle live broadcasting, high-definition video orchestration, and remote collaboration based on 5G networks. Future advancements will enable centralized processing, orchestration, and distribution of diverse content, supporting both 5G ultra-high-definition production and 5G VR/AR/MR broadcasting. Additionally, 5G lightweight studios facilitate mobile on-site reporting, front-end studios, mobile production, and live connections. Remote collaborative editing represents a mobile audience-end application based on 5G and edge cloud computing, allowing production staff to edit high-definition and ultra-high-definition materials anytime and anywhere using mobile terminals.

2. Necessity of Applying 5G Technology in Broadcasting Television

Compared with 4G technology, 5G offers numerous advantages including higher signal transmission quality, faster speeds, and broader coverage. These capabilities enable broadcasters to produce more diverse, high-quality programs, delivering superior services to audiences. Furthermore, 5G technology drives technological innovation and operational optimization throughout the broadcasting television industry.

3. Analysis of Network Security Risks Faced by Broadcasting Television Under 5G Network Environment

3.1 Network Security Risks in Technical Aspects

As 5G technology becomes more deeply integrated into broadcasting television, the industry faces several key technical security risks.

3.1.1 NFV Technology NFV technology enables dynamic reconfiguration and management of virtual infrastructure platforms. However, security vulnerabilities exist in practical applications. Since NFV' s core involves managing and controlling virtual infrastructure platforms, external attacks can directly compromise virtual machines. Moreover, NFV creates increasingly close and complex interconnections among virtual machines, meaning an attack on one VM can affect all connected VMs.

3.1.2 SDN Technology SDN technology separates network infrastructure control from data forwarding, offering strong flexibility and intelligence. While it enhances information transmission speed and quality while saving manpower and time, SDN' s open-source nature creates significant security risks. Open-source code provides attackers with vulnerabilities, making it difficult to effectively intercept external access and attacks, thereby creating systemic security hazards.

3.1.3 Network Slicing Network slicing creates independent network conditions while allowing different slices to share common network equipment. Each slice' s configuration and transmission typically correspond to specific network services, improving management efficiency and service targeting. However, this model introduces security concerns. Since different network slices maintain varying security levels, attacks on the network server often breach less secure slices first, subsequently compromising more secure slices and undermining overall server security.

3.1.4 MEC Technology MEC technology provides services for edge users by shifting cloud computing capabilities to the network edge, increasing system openness and reducing network security protection capabilities. Additionally,

limited resources at the network edge cannot effectively guarantee security, further elevating network security risks.

3.1.5 Multiple Access Forms and Device Types The application of 5G technology has upgraded networks and equipment, significantly diversifying access devices and methods. However, this diversification generates new security risks. Network terminal devices are highly vulnerable to malicious attacks during handovers, while varied access forms and devices substantially increase the difficulty of terminal identity authentication management. Without accurate user identification, network security cannot be ensured.

3.2 Network Security Risks in Business Applications

Beyond technical risks, various security challenges exist throughout business application stages under 5G technology.

3.2.1 Terminal Access Issues While 5G technology expands data collection channels and methods in broadcasting television, it also creates security vulnerabilities in data acquisition. Current terminal access mutual authentication levels remain low, preventing effective identity authentication and management in high-security environments, particularly during video and user terminal authentication processes.

3.2.2 Remote Collaboration Issues Remote collaboration represents a major 5G advantage that significantly improves efficiency and optimizes workflows. However, numerous security risks exist. For instance, remote collaboration via certain software without comprehensive security settings is highly vulnerable to external attacks. Additionally, issues such as illegal downloads and brute-force cracking frequently occur, severely impacting collaboration and hindering future 5G applications in broadcasting television.

3.2.3 High-Tech Content Issues Current security software cannot quickly scan large, time-sensitive high-tech video files, making it impossible to guarantee their security. Moreover, quality and standardization of high-tech video content remain difficult to ensure, and effective monitoring methods for such content are still lacking.

3.2.4 Interconnection Issues While 5G enables high-quality, high-speed, low-latency file distribution for broadcasting television production systems, it simultaneously creates security problems. For example, comprehensive monitoring systems for radio and television program distribution are still underdeveloped, and monitoring of network terminal application software is insufficient. Furthermore, to meet audience interaction demands, production systems must connect with the internet after program broadcasting, further increasing security

risks. Additionally, audience terminal devices vary widely, making implementation of various identity verification systems difficult and creating cross-regional authentication risks.

4. Effective Strategies for Broadcasting Television to Address Network Security Risks Under 5G Network Environment

4.1 Strengthening Innovation in Application Technologies

While 5G technology drives broadcasting television development, it demands greater innovation in related application technologies. To leverage 5G advantages while avoiding security risks, the industry must enhance technological innovation and build scientifically sound wireless interaction systems using AI, big data, and other technologies. Although 5G technology has matured and expanded its application scope, defects remain in broadcasting television applications. Therefore, the industry must first recognize problems exposed during 5G implementation, then rationally allocate resources and build functional modules based on industry characteristics and 5G application requirements.

4.2 Strengthening Optimization of Application Architecture

Adjusting and optimizing application architecture constitutes an effective measure to avoid and resist network security risks. 5G implementation in broadcasting television involves more than simply adopting new technology. To fully realize 5G advantages, managers must optimize all industry aspects and actively adjust application architecture to form a scientifically sound 5G application system. Specifically, architecture optimization includes three dimensions: application environment, broadcasting television business, and mobile terminals. Application environment refers to various differentiating factors during implementation; business concerns video-on-demand services; and terminals address differences between mobile small screens and fixed large screens. During framework optimization, first enhance wireless network security protection to safeguard subsequent program production and distribution; second, use UPCF as the core module to build interactive platforms; and third, optimize user terminals to improve application software security.

4.3 Strengthening Construction of Talent Teams in Broadcasting Television Industry

Talent teams represent the main force for integrating broadcasting television technology with 5G networks, and their comprehensive capabilities directly impact program production quality. Therefore, talent team construction must be strengthened to ensure efficient broadcasting television operations. Specifically, this includes: first, cultivating staff work concepts by evaluating not only theoretical and technical competencies but also professional ethics; second, conducting business capability training to enhance learning awareness and foster

continuous improvement; and third, from practitioners' perspective, fully recognizing 5G' s value in broadcasting television, strengthening 5G technology learning, and actively applying internet theories and technologies to practical work.

In summary, as 5G technology becomes more deeply integrated into broadcasting television, it accelerates industry development while creating various network security hazards. To leverage 5G advantages while avoiding security risks, in-depth research and analysis of current security challenges are essential. Only by implementing effective measures to enhance network security can a solid foundation be established for the sustainable development of broadcasting television.

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Note: Figure translations are in progress. See original paper for figures.